An Historic Global SO_2 Emissions Inventory for Climate Detection Studies FY96 Report to NOAA

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The response of the Earth's climate due to increased concentrations of infrared absorbing (greenhouse) gases is the subject of intense research because of the well documented increases in concentrations of these gases over the industrial era, and the recognition of the dramatic importance of the radiative forcing associated with these increases. It is becoming apparent that anthropogenic aerosols exert radiative influence on climate that is globally comparable to that of the greenhouse gases but opposite in sign. This aerosol radiative influence has received much less attention than the forcing by anthropogenic greenhouse gases. In view of the magnitude of the aerosol influences on climate, it seems mandatory that these influences should be included in efforts to obtain accurate estimates of anthropogenic perturbation to the Earth's radiation budget at present and over the industrial era.

In FY96 we have performed statistical theoretical modeling to improve the predictive understanding of atmospheric trace gases that influence the Earth's chemical and radiative balance, by developing spatially and temporally resolved emissions inventories of SO_2 from fossil fuel combustion. We have estimated the SO_2 emissions from fossil fuel combustion on an annual basis since from 1950 through 1990. The Figure illustrates the mass in kg S of emitted SO_2 for the year 1990 on a 1×1 degree grid basis. Work is continuing to update these estimates through the current decade and to incorporate other industrial sources into the inventory.

This modeling effort will provide data and information for climate detection studies that will help to elucidate the role of anthropogenic aerosols in climate forcing over interannual and decadal time scales. Analysis of this data along with changes in the observed climate record should provide additional evidence of human induced changes in climate forcing. This project is advancing our understanding of the relationship between human society and climate system function.

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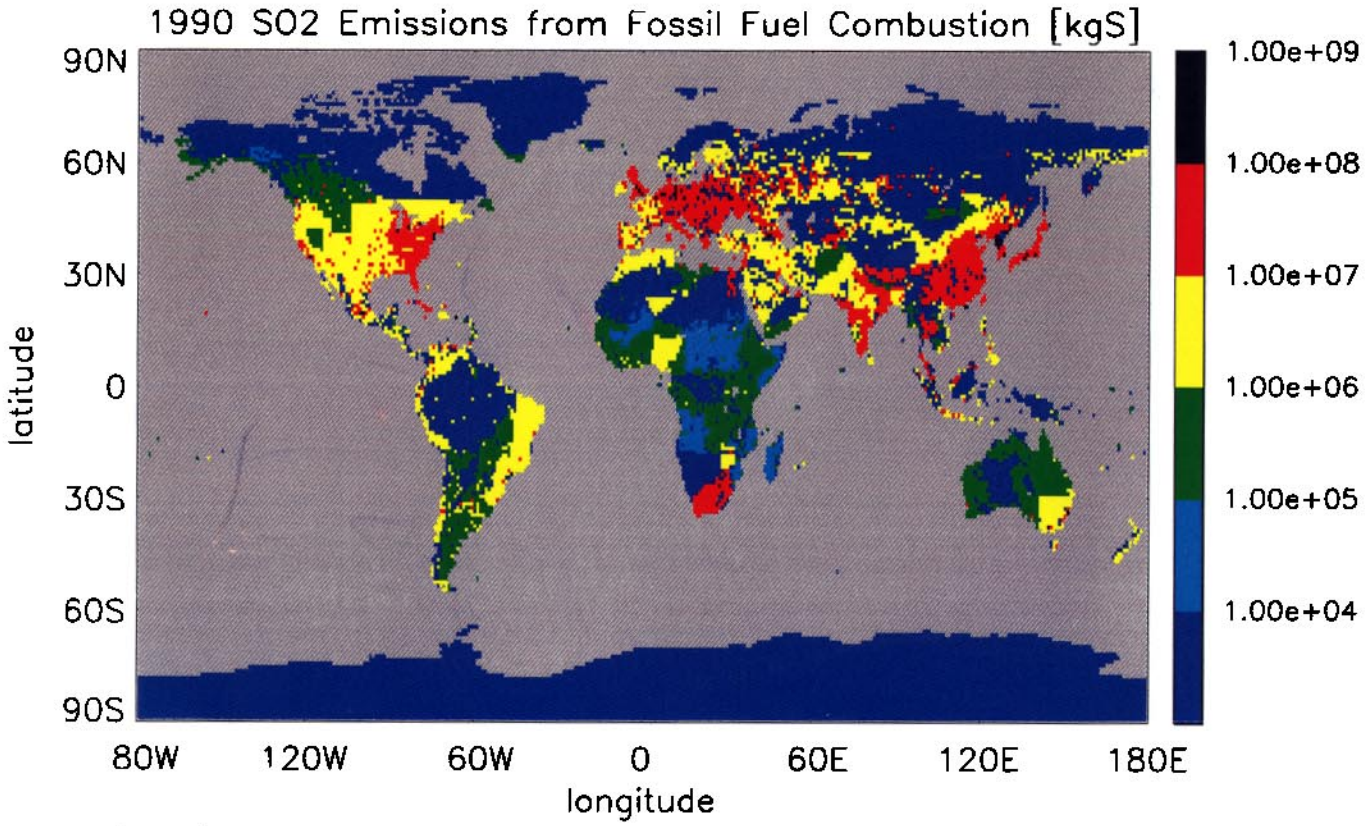
1990 SO2 Emissions from Fossil Fuel Combustion [kgS]
90N
60N
30N
0
30S
60S
90S
latitude
80W
120W
60W
0
60E
120E
180E
longitude
1.00e+09
1.00e+08
1.00e+07
1.00e+06
1.00e+05
1.00e+04

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